CLAIMS

That which is claimed is:

1. A conductive ink comprising:
   (a) a thermally curable resin system comprising
      (i) one or more of a maleimide, nadimide, or itaconimide,
      (ii) optionally, a comonomer, and
      (iii) a catalyst;
   (b) a particulated electrically conductive material; and
   (c) optionally, an organic solvent.

2. The conductive ink of claim 1, further comprising at least one additional component selected from the group consisting of flow additives, adhesion promoters, rheology modifiers, electrical enhancers, stabilizers, and mixtures of any two or more thereof.

3. The conductive ink of claim 2, wherein the ink comprises:

(a) in the range of about 1 to 20 weight percent of the thermally curable resin system, wherein the weight ratio of the one or more maleimide, nadimide, itaconimide, or combination/comonomer/catalyst in the resin system falls in the range of about 2-100/4-200/1;

(b) in the range of about 40 to 90 weight percent of the particulated electrically conductive material;

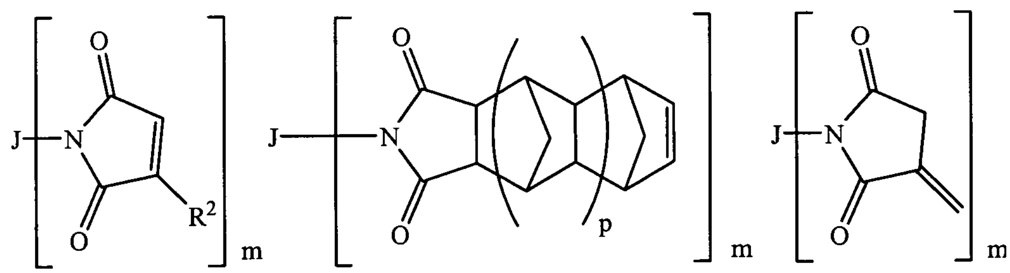
(c) in the range of about 0 to 50 weight percent of the organic solvent; and

(d) in the range of about 0.5 to 10 weight percent of the at least one additional component selected from the group consisting of flow additives,

adhesion promoters, rheology modifiers, electrical enhancers, stabilizers, and mixtures of any two or more thereof;

wherein weight percent is based on the total of components (a), (b), (c), and (d).

4. The conductive ink of claim 1, wherein the one or more maleimide, nadimide, or itaconimide comprise, respectively, the structures **I**, **II**, and **III**:



I **II** **III**

wherein:

m = 1-15,

p = 0-15,

each R^2 is independently selected from hydrogen or lower alkyl, and

J is a monovalent or a polyvalent moiety comprising organic or organosiloxane radicals, and combinations thereof.

5. The conductive ink of claim 4, wherein:

J is a monovalent or polyvalent radical selected from the group consisting of hydrocarbyl, substituted hydrocarbyl, heteroatom-containing hydrocarbyl, substituted heteroatom-containing hydrocarbyl, hydrocarbylene, substituted hydrocarbylene, heteroatom-containing hydrocarbylene, substituted heteroatom-containing hydrocarbylene, polysiloxane, polysiloxane-polyurethane block copolymer, and combinations of two or more thereof, optionally containing one or more linkers selected

from the group consisting of a covalent bond, -O-, -S-, -NR-, -O-C(O)-, -O-C(O)-O-, -O-C(O)-NR-, -NR-C(O)-, -NR-C(O)-O-, -NR-C(O)-NR-, -S-C(O)-, -S-C(O)-O-, -S-C(O)-NR-, -S(O)-, $-S(O)_2-$, $-O-S(O)_2-$, $-O-S(O)_2-O-$, $-O-S(O)_2-NR-$, -O-S(O)-, -O-S(O)-O-, -O-S(O)-NR-, -O-NR-C(O)-, -O-NR-C(O)-O-, -O-NR-C(O)-NR-, -NR-O-C(O)-, -NR-O-C(O)-O-, -NR-O-C(O)-NR-, -O-NR-C(S)-, -O-NR-C(S)-O-, -O-NR-C(S)-NR-, -NR-O-C(S)-, -NR-O-C(S)-O-, -NR-O-C(S)-NR-, -O-C(S)-, -O-C(S)-O-, -O-C(S)-NR-, -NR-C(S)-, -NR-C(S)-O-, -NR-C(S)-NR-, $-S-S(O)_2-$, $-S-S(O)_2-O-$, $-S-S(O)_2-NR-$, -NR-O-S(O)-, -NR-O-S(O)-O-, -NR-O-S(O)-NR-, $-NR-O-S(O)_2-$, $-NR-O-S(O)_2-O-$, $-NR-O-S(O)_2-NR-$, -O-NR-S(O)-, -O-NR-S(O)-O-, -O-NR-S(O)-NR-, $-O-NR-S(O)_2-O-$, $-O-NR-S(O)_2-NR-$, $-O-NR-S(O)_2-$, $-O-P(O)R_2-$, $-S-P(O)R_2-$, $-NR-P(O)R_2-$, wherein each R is independently hydrogen, alkyl or substituted alkyl, and combinations of any two or more thereof.

6. The conductive ink of claim 4, wherein:

m = 1-6,

p = 0-6, and

J is

(a) saturated straight chain alkyl or branched chain alkyl, optionally containing substituents selected from hydroxy, alkoxy, carboxy, nitrile, cycloalkyl cycloalkenyl, or optionally substituted aryl moieties as substituents on the alkyl chain or as part of the backbone of the alkyl chain, and wherein the alkyl chains have up to about 20 carbon atoms;

(b) alkylene, oxyalkylene, alkenyl, alkenylene, oxyalkenylene, ester, or polyester, optionally containing substituents selected from hydroxy, alkoxy, carboxy, nitrile, cycloalkyl or cycloalkenyl;

(c) a siloxane having the structure $-(C(R^3)_2)_d-[Si(R^4)_2-O]_f-Si(R^4)_2-(C(R^3)_2)_e-$, $-(C(R^3)_2)_d-C(R^3)-C(O)O-(C(R^3)_2)_d-[Si(R^4)_2-O]_f-Si(R^4)_2-(C(R^3)_2)_e-$

$O(O)C\text{-}(C(R^3)_2)_e\text{-}$, or $\text{-}(C(R^3)_2)_d\text{-}C(R^3)\text{-}O(O)C\text{-}(C(R^3)_2)_d\text{-}[Si(R^4)_2\text{-}O]_f\text{-}Si(R^4)_2\text{-}(C(R^3)_2)_e\text{-}C(O)O\text{-}(C(R^3)_2)_e\text{-}$

wherein:

each R^3 is independently hydrogen, alkyl or substituted alkyl,

each R^4 is independently hydrogen, lower alkyl or aryl,

$d = 1\text{-}10$,

$e = 1\text{-}10$, and

$f = 1\text{-}50$;

(d) a polyalkylene oxide having the structure:

$$[(CR_2)_r\text{-}O\text{-}]_f\text{-}(CR_2)_s\text{-}$$

wherein:

each R is independently hydrogen, alkyl or substituted alkyl,

$r = 1\text{-}10$,

$s = 1\text{-}10$, and

f is as defined above;

(e) aromatic groups having the structure:

$$\text{Ar-}\overset{\overset{\displaystyle O}{\|}}{C}\text{-O-Z-O-}\overset{\overset{\displaystyle O}{\|}}{C}\text{-Ar-}$$

wherein each Ar is a monosubstituted, disubstituted or trisubstituted aromatic or heteroaromatic ring having in the range of 3 up to 10 carbon atoms, and Z is:

(i) saturated straight chain alkylene or branched chain alkylene, optionally containing saturated cyclic moieties as substituents on the alkylene chain or as part of the backbone of the alkylene chain, or

(ii) polyalkylene oxides having the structure:

$\text{-}[(CR_2)_r\text{-}O\text{-}]_q\text{-}(CR_2)_s\text{-}$

wherein:

each R is independently defined as above,

$r = 1\text{-}10$,

$s = 1\text{-}10$, and

$q = 1\text{-}50$;

(f) di- or tri-substituted aromatic moieties having the structure:

$$(CR_2)_t\text{-}O\text{-}(C{=}O)\text{-}Ar\text{-}[(C{=}O)\text{-}O\text{-}(CR_2)_a]_{1,2}\text{—}$$

wherein:

each R is independently defined as above,

$t = 2\text{-}10$,

$a = 2\text{-}10$, and

Ar is as defined above;

(g) aromatic groups having the structure:

$$-Ar-[(\overset{O}{\overset{\|}{C}})_{0,1}\text{-}O-(CR_2)_t]_u\ ,\quad -Ar-[-O\,(\overset{O}{\overset{\|}{C}})_{0,1}-(CR_2)_t]_u\ ,$$

$$Ar-E-\overset{O}{\overset{\|}{C}}-\underset{R}{N}-\ ,\qquad Ar-E-\underset{R}{N}-\overset{O}{\overset{\|}{C}}-\ ,$$

$$W\left[(\overset{O}{\overset{\|}{C}})_{0,1}-O-Ar\right]_g-\qquad \text{or} \qquad W\left[O-(\overset{O}{\overset{\|}{C}})_{0,1}-Ar\right]_g-$$

wherein:

$t = 2\text{-}10$,

$u = 1, 2$ or 3,

$g = 1$ up to about 50,

each R is independently defined as above,

each Ar is as defined above,

E is -O- or $-NR^5-$, wherein R^5 is hydrogen or lower alkyl;

and

W is

(i) straight or branched chain alkyl, alkylene, oxyalkylene, alkenyl, alkenylene, oxyalkenylene, ester, or polyester, optionally containing substituents selected from hydroxy, alkoxy, carboxy, nitrile, cycloalkyl or cycloalkenyl,

(ii) a siloxane having the structure $-(C(R^3)_2)_d-[Si(R^4)_2-O]_f-Si(R^4)_2-(C(R^3)_2)_e-$, $-(C(R^3)_2)_d-C(R^3)-C(O)O-(C(R^3)_2)_d-[Si(R^4)_2-O]_f-Si(R^4)_2-(C(R^3)_2)_e-O(O)C-(C(R^3)_2)_e-$, or $-(C(R^3)_2)_d-C(R^3)-O(O)C-(C(R^3)_2)_d-[Si(R^4)_2-O]_f-Si(R^4)_2-(C(R^3)_2)_e-C(O)O-(C(R^3)_2)_e-$ wherein,

each R^3 is independently hydrogen, alkyl or substituted alkyl,

each R^4 is independently hydrogen, lower alkyl or aryl,

$d = 1$-10,

$e = 1$-10, and

$f = 1$-50; or

(iii) a polyalkylene oxide having the structure:

$-[(CR_2)_r-O-]_f-(CR_2)_s-$

wherein:

each R is independently defined as above,

$r = 1$-10,

$s = 1$-10, and

f is defined as above;

optionally containing substituents selected from hydroxy, alkoxy, carboxy, nitrile, cycloalkyl or cycloalkenyl;

(h) a urethane group having the structure:

R^7-U-C(O)-NR^6-R^8-NR^6-C(O)-(O-R^8-O-C(O)-NR^6-R^8-NR^6-C(O))$_v$-U-R^8-

wherein:

each R^6 is independently hydrogen or lower alkyl;

each R^7 is independently an alkyl, aryl, or arylalkyl group having 1 to 18 carbon atoms;

each R^8 is an alkyl or alkyloxy chain having up to about 100 atoms in the chain, optionally substituted with Ar;

U is -O-, -S-, -N(R)-, or -P(L)$_{1,2}$- wherein R as defined above, and wherein each L is independently =O, =S, -OR or -R; and

v = 0-50;

(i) polycyclic alkenyl; or

(j) mixtures of any two or more thereof.

7. The conductive ink of claim 6, wherein J is of sufficient length to render liquid the one or more maleimide, nadimide, or itaconamide, at ambient temperature.

8. The conductive ink of claim 6, wherein

m = 1, 2, or 3, and

J is of sufficient length and branching to render liquid the one or more maleimide, nadimide, or itaconamide, at ambient temperature.

9. The conductive ink of claim 6 wherein J of the one or more maleimide, nadimide, or itaconamide is 10,11-dioctyl-eicosylene.

10. The conductive ink of claim 1 wherein the comonomer comprises a (meth)acrylate, epoxy, vinyl ether, vinyl ester, vinyl ketone, vinyl aromatic, vinyl cycloalkyl, allyl amide, or combination of any two or more thereof.

11. The conductive ink of claim 1, wherein the comonomer comprises an epoxy.

12. The conductive ink of claim 1, wherein the comonomer comprises a (meth)acrylate.

13. The conductive ink of claim 1, wherein the comonomer comprises a vinyl ether.

14. The conductive ink of claim 1, wherein the comonomer comprises a (meth)acrylate and vinyl ether.

15. The conductive ink of claim 1, wherein the comonomer comprises a (meth)acrylate and epoxy.

16. The conductive ink of claim 1, wherein the catalyst is a free radical initiator.

17. The conductive ink of claim 16, wherein the free radical initiator is a peroxide, azo compound, or combination of any two or more thereof.

18. The conductive ink of claim 17, wherein the free radical initiator is selected from the group consisting of dicumyl peroxide, dibenzoyl peroxide, 2-butanone peroxide, *tert*-butyl perbenzoate, di-*tert*-butyl peroxide, 2,5-bis(*tert*-butylperoxy)

-2,5-dimethylhexane, bis(*tert*-butyl peroxyisopropyl) benzene, *tert*-butyl hydroperoxide, and mixtures of any two or more thereof.

19. The conductive ink of claim 1, wherein the particulated electrically conductive material is selected from the group consisting of silver, copper, silver-coated copper, gold-coated copper, silver-coated aluminum, gold-coated aluminum, coated mica, glass spheres, and mixtures of any two or more thereof.

20. The conductive ink of claim 1 wherein the organic solvent is present and is selected from the group consisting of a hydrocarbon, ether, alcohol, ester, ketone, and mixtures of any two or more thereof.

21. The conductive ink of claim 20 wherein the organic solvent is an ester.

22. The conductive ink of claim 21 wherein the ester is amyl acetate.

23. The conductive ink of claim 2, wherein the flow additives are selected from the group consisting of silicon polymers, ethyl acrylate/2-ethylhexyl acrylate copolymers, alkylol ammonium salt of acid phosphoric acid esters of ketoxime, and mixtures of any two or more thereof.

24. The conductive ink of claim 2, wherein the adhesion promoter is a silane with a curable functional group.

25. The conductive ink of claim 24 wherein the curable functional group is a carbon-carbon double bond or an epoxy.

26. The conductive ink of claim 2, wherein the adhesion promoter is selected from the group consisting of a mercaptosilane, an epoxysilane, an aminosilane, a trialkoxysilyl isocyanurate, and mixtures of any two or more thereof.

27. The conductive ink of claim 2, wherein the rheology modifier is a thixotrope.

28. The conductive ink of claim 2, wherein the rheology modifier is a thermoplastic resin.

29. The conductive ink of claim 28, wherein the rheology modifier is selected from the group consisting of a polystyrene-polybutadiene copolymer, a poly(methyl methacrylate), a poly(ethyl methacrylate), a polyvinyl acetal, and mixtures of any two or more thereof.

30. The conductive ink of claim 2, wherein the electrical enhancer is selected from the group consisting of hydroquinone, Vitamin E, metallic dryers, metallic (meth)acrylates, titanates, phosphoric acid, and mixtures of any two or more thereof.

31. A conductive ink consisting essentially of

(a) in the range of about 1 to 20 weight percent of a thermally curable resin system system comprising

(i) one or more of a maleimide, nadimide, or itaconimide,

(ii) optionally, a comonomer, and

(iii) a catalyst;

wherein the weight ratio of the one or more maleimide, nadimide, or itaconimide/comonomer/catalyst in the resin system falls in the range of about 2-100/4-200/1;

(b) in the range of about 40 to 90 weight percent of a particulated electrically conductive material;

(c) in the range of about 0 to 50 weight percent of an organic solvent; and

(d) in the range of about 0 to 10 weight percent of at least one additional component selected from the group consisting of flow additives, adhesion promoters, rheology modifiers, electrical enhancers, stabilizers, and mixtures of any two or more thereof;

wherein weight percent is based on the total of components (a), (b), (c), and (d).

32. A process for producing a conductive layer or coating comprising applying an ink of claim 1 to a substrate.

33. The process of claim 32, wherein the substrate is a printed wiring board.

34. The process of claim 33, wherein the printed wiring board is an epoxy glass-type printed wiring board or a phenolic-type printed wiring board.

35. The process of claim 32, wherein the substrate is a capacitor component.

36. The process of claim 32, wherein the ink is applied to the substrate by dipping or screen printing.

37. An article comprising a substrate containing a cured aliquot of a composition of claim 1.

38. The article of claim 37, wherein the substrate is a printed wiring board or a capacitor component.